Protective coating systems for cargo oil tanks - Non-metallic materials
FOREWORD

DNV GL class programmes contain procedural and technical requirements including acceptance criteria for obtaining and retaining certificates for objects and organisations related to classification.

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Any comments may be sent by e-mail to rules@dnvgl.com

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Changes – Current

This is a new document.
CONTENTS

Changes – current................................................................................................................3

Section 1 General.................................................................................................................. 5
  1 Introduction.................................................................................................................. 5
  2 Documentation.............................................................................................................6

Section 2 Requirements..................................................................................................... 8
  1 Design requirements................................................................................................. 8
  2 Requirements for production and quality control arrangement............................. 8
  3 Requirements for material......................................................................................... 8
  4 Requirements for marking of product......................................................................11

Appendix A Work processes............................................................................................12

Appendix B Guidelines on formulation and name changes in relation to IMO PSPC coating system type approval..............................................................15
  1 Allowed changes without reference to DNV GL...............................................15
  2 Allowed changes with reference to DNV GL, but without re-testing to IMO PSPC.................................................................................................15
  3 Changes not allowed without full re-testing to IMO PSPC and subsequent type approval.................................................................15
SECTION 1 GENERAL

1 Introduction

1.1 Objective

The objective of this class programme (CP) is to describe the type approval (TA) scheme for protective coating systems for cargo oil tanks.

The general requirements for obtaining DNV GL type approval certificate is given in class programme DNVGL CP 0338 Type approval scheme

The procedures and requirements described in this CP are applicable for obtaining TA certificate based on requirements in:

— IMO Resolution MSC.288(87), IMO Performance Standard for Protective Coatings for Cargo Oil Tanks of Crude Oil Tankers (IMO PSPC-COT)
— IACS UI SC 259 For Application of SOLAS Regulation II-1/3-11 Performance Standard for Protective Coatings for Cargo Oil Tanks of Crude Oil Tankers (PSPC-COT), adopted by Resolution MSC.288(87)
— IMO MSC.1/1479, Unified Interpretation on the application of the Performance Standard for Protective Coatings for Cargo Oil Tanks of Crude Oil Tankers (Resolution MSC.288(87))
— The standards listed in the IMO Resolution MSC.288(87), and which are made mandatory via IACS UI SC 259
— IACS Recommendations No. 116, Performance Standard for Protective Coatings for Cargo Oil Tanks of Crude Oil Tankers, February 2011
— RU Ship Pt.6 Ch.1 Sec.9

Guidance note:
This class programme is not applicable for obtaining EU Marine Equipment Directive (MED) certificates. Visit www.dnvgl.com for information on MED certification.

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1.2 Scope

This CP gives a description of the procedures and requirements related to documentation, design and type testing applicable for TA of protective coating systems for cargo oil tanks.

This CP does not set the design requirements to the protective coating systems - cargo oil tanks. TA is based on compliance with design requirements given in the Society’s Rules and/or other regulations and standards. The CP describes how to document compliance with the requirements in order to obtain a TA certificate for the equipment. This includes, where relevant, technical requirements for how the type tests shall be performed.

The Society’s type approval certificate will cover one grade of the actual product with the possibility to include variants.

For the coating system, this means:
— grade: full coating system, including one or more coats (as per system definition)
— variants: colour variants and similar

The Society’s type approval certificate is normally limited to one manufacturer at one production site.

The approval is solely connected to the corrosion prevention properties of the coating system. The approval does not include any evaluation of toxicity, contamination, pollution, or fire technical properties.

Type tests as specified in Sec.2 [3], shall be carried out and verified in one of the following ways:
— at a Society laboratory
— at a recognized and independent laboratory or a laboratory accepted by the Society
— at the manufacturer's premises in the presence of a Society's surveyor.

As the approval of service supplier, see CP 0277, may be granted to laboratories either independent of the coating manufacturer or to the coating manufacturer's own laboratory there will be a different follow-up from the surveyor during the testing period.

When actual testing, forming basis for test reports used to seek type approval from the Society, is carried out at the coating manufacturer's own laboratory the responsible surveyor shall be called in for witnessing milestones, typically:

— witnessing of selection of paint material from stock if applicable
— witnessing of sample surface preparation
— witnessing of primer application & weathering
— examination of surface and preparation prior to application of top coat
— witnessing of top coat application
— witnessing during testing
— witnessing evaluation of test.

Please refer to App.A for flow charts showing the involvement of the Society (e.g. Society's surveyor).

1.3 Application

DNV GL rules RU SHIP Pt.6 Ch.1 Sec.9 and IMO MSC.288(87) require that protective coating systems for cargo oil tanks are type approved in accordance with this CP for cargo oil tanks on Society-classed crude oil carriers.

A TA certificate in accordance with this CP will confirm compliance with the requirements in the rules as specified in [1.1]. The TA certificate will not confirm compliance with requirements in other parts of the rules. In case additional requirements in other parts of the rules shall be covered by the TA certificate, this shall be specified in the application for TA and will be stated in the TA certificate.

2 Documentation

For TA of protective coating systems for cargo oil tanks the following documentation shall be submitted by the manufacturer at initial type approval and updated, at renewal. The documentation shall, to the extent possible, be submitted as electronic files. The manufacturer shall keep one (1) copy of the type approval documentation in their own file. The documentation that forms the basis for the TA shall be easily available for the Society's surveyors at the TA applicant's premises. When documentation is submitted in paper format, normally two copies of the documentation shall be submitted to the Society. No documentation will be returned to the company applying for TA.

The documentation shall be in the English language, if not otherwise agreed. (Please number documentation according to below list to facilitate review):

1) the Society's type approval application form shall be completed with the following information:
   — type designation, i.e. product name (grade) with list of variants to be included in, and stated on, the type approval certificate
   — name and address of manufacturer, to be listed on type approval certificate. Additionally, the following shall be specified, if applicable:
     — contact person
     — phone and fax numbers
     — e-mail and web address.

2) product description (number and type of components, colour, consistence, etc.)

3) field of application and special application limitations of the product (temperature, dry film thickness, number of coats etc.)

4) product specification/technical data sheet/material safety data sheet, with relevant product information.
5) description of fabrication process

6) description of quality control arrangement including copies of the relevant certificates with issue number and/or date (e.g., quality management system certification)

7) type test results with references to standards, methods etc. and relevant calibration certificates for equipment used in type tests (if applicable)

8) information regarding marking of the product or package

9) in-service experience, if available.

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1 To be verified during initial type approval survey prior to the issuance of the type approval certificate
SECTION 2 REQUIREMENTS

1 Design requirements

The protective coating systems for cargo oil tanks shall comply with the relevant requirements given in Sec.1 [1.1].

The Type Approval comprises the shop primer and main coating in liquid condition and in the condition when applied in full compliance with the manufacturer’s recommendations (see Sec.1 [2], items 4 and 5). Quality control during surface preparation or application of the shop primer and main coating is, however, not included in the type approval.

The type approval certificate is invalid if the formulation of the main coating is changed to a degree deemed significant by the Society or if the formulation of any of the listed pre-qualified shop primers is changed to a degree deemed significant by the Society that the shop primer cannot be used as part of the protective coating system.

Changes to technical data sheets and material safety data sheets with basis in formulation changes as well as significant changes in the application procedures (e.g., changes in the maximum or minimum overcoating interval) shall be informed to the Society by the coating manufacturer. Guidelines on formulation and name changes in relation to IMO PSPC coating system type approval can be found in App.2.

2 Requirements for production and quality control arrangement

The manufacturer should have a quality system that meets ISO 9001 standards, or equivalent. If this quality standard is not fulfilled, the extent of type testing and assessments will be specially considered.

The quality control arrangement shall be checked with respect to:

— control of incoming materials
— test equipment, test methods, test samples and reference to standards used
— traceability and marking system
— production test reports, production records
— storage conditions and procedures.

3 Requirements for material

The coating product including any variants shall be defined and documented as given in Sec.1 [2].

The requirements for coating properties and performance in field or laboratory exposure are described below for the alternative test methods.

Guidance note:

A prerequisite is that the laboratory, either recognised and independent from the coating manufacturer or the coating manufacturer’s own laboratory, involved with testing of coating systems in accordance with IMO Resolution MSC.288(87) and IACS UI SC 259 is approved as a service supplier in accordance with IACS UR Z17, as amended. DNVGL CP 0277 “Laboratories engaged in testing of coating systems (IMO PSPC)” will be presented to those interested in obtaining such approval.

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3.1 IMO Resolution MSC.288(87) test procedures

Method 1

For coating systems to be used in cargo oil tanks in crude oil tankers.

The test procedures are outlined in:

— IMO Resolution MSC.288(87), Annex 1, Appendix 1 Gas-tight cabinet test
— IMO Resolution MSC.288(87), Annex 1, Appendix 2 Immersion test
Precautions regarding the use of dangerous materials

Acceptance criteria:

— IMO Resolution MSC.288(87), Annex 1, Appendix 3 Precautions regarding the use of dangerous materials.

If type testing according to Method 1 has been carried out, and the results found to be satisfactory, the following will be stated on the type approval certificate:

“For use in cargo oil tanks of crude oil tankers. Surface preparation and coating application as per PSPC or manufacturer’s recommendations, whichever is stricter”.

3.2 Field Exposure

Method 2

For coating systems to be used in cargo oil tanks in crude oil tankers.

The requirements for field exposure are given in IMO Resolution MSC.288(87), Table 1 item 3 (1.3). Further, reference is given to IACS Rec. No. 116.

If field exposure according to Method 4 has been carried out, and the results found to be satisfactory, the following will be stated on the type approval certificate:

“For use in cargo oil tanks of crude oil tankers. Surface preparation and coating application as per PSPC or manufacturer’s recommendations, whichever is stricter”.

3.3 Alternative systems

Method 3

All systems that are not an epoxy based system, and/or systems not applied according to Table 1 of the IMO Resolution MSC.288(87) are defined as an alternative system.

It is not meant to exclude other alternative systems with proven equivalent performance, for example, non-epoxy based systems.

Acceptance of alternative systems will be subject to documented evidence that they ensure a corrosion prevention performance at least equivalent to that indicated in the IMO Resolution MSC.288(87).

As a minimum, the documented evidence shall consist of satisfactory performance corresponding to that of a coating system which conforms to the “coating standard” described in the IMO Resolution MSC.288(87), Section 4, i.e., a target useful life of 15 years in either actual field exposure for 5 years with final coating condition not less than “GOOD” or laboratory testing. The laboratory testing shall be carried out in accordance with the test procedures and acceptance criteria given in the IMO Resolution MSC.288(87), App.1, Appendix 1 (Gas-tight cabinet test) and Appendix 2 (Immersion test).

Further, reference is given to the latest revisions of IACS UI SC 259 and IMO MSC.1/1479 regarding the latest IACS and IMO interpretation on this matter.

If Type Testing according to Method 3 has been carried out, and the results found to be satisfactory, the following will be stated on the type approval certificate:

“For use in cargo oil tanks of crude oil tankers. Surface preparation and coating application as per PSPC or manufacturer’s recommendations,”.

In addition, it will be stated that the coating system has been accepted as “alternative system” with clear indication of this categorization, i.e., not epoxy based and/or not applied according to Table 1 of the IMO Resolution MSC.288(87) with further application notes.

3.4 Cross-over tests – compatibility tests

This sub-section is relevant for Method 1 and 3, excluding Method 2.

If a zinc silicate shop primer has passed the pre-qualification test as part of coating system (i.e., shop primer plus epoxy main coating), it may be used in combination with other epoxy main coatings that have
passed the pre-qualification test as part of another coating system, provided that the compatibility has been confirmed by the test in accordance with either:

— IMO Resolution MSC.288(87), Annex 1, Appendix 2 (Immersion test), or
— IMO Resolution MSC.215(82), Paragraph 1.7 of Appendix 1 to Annex 1 (Test on simulated ballast tank condition) without wave movement.

The cross-over tests are also to be carried out by a laboratory approved as a service supplier. When cross-over tests have been carried out and reported satisfactorily the information may be included to the type approval certificate.

3.5 Summary

Table 1 Type testing - laboratory testing and field testing

<table>
<thead>
<tr>
<th>Property</th>
<th>Test Standard</th>
<th>Number and selection of specimen</th>
<th>Value</th>
<th>Definition of Value</th>
<th>Minimum level of verification</th>
<th>Frequency of verification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coating durability (visual assessment)</td>
<td><strong>Method 1</strong>&lt;br&gt;IMO Resolution MSC.288(87), Annex 1, Appendix 1 and Appendix 2, Gas-tight cabinet test and immersion test cyclus</td>
<td>See details in Sec.2 [3.1]</td>
<td>Acceptance criteria in IMO Resolution MSC.288(87)</td>
<td>See details in Sec.2 [3.1]</td>
<td>Report by a laboratory approved as a Service Supplier</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Method 2</strong>&lt;br&gt;Field exposure&lt;br&gt;Field test under real life exposure conditions for min. 5 years</td>
<td>See details in Sec.2 [3.2] and IACS Rec. No. 116</td>
<td>Final coating condition not less than “GOOD”</td>
<td>See details in Sec.2 [3.2]</td>
<td>Report by independent institution, or, preferably, by a Society’s surveyor</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Method 3</strong>&lt;br&gt;Alternative Systems&lt;br&gt;All systems that are not an epoxy based one and/or systems not applied according to table 1 of the IMO Resolution MSC.288(87) are defined as an alternative system.The performance shall be shown in accordance with either Method 1 or 2.</td>
<td>See details in Sec.2 [3.3]</td>
<td>Final coating condition not less than “GOOD”</td>
<td>See details in Sec.2 [3.3]</td>
<td>Report by independent institution, or, preferably, by a Society’s surveyor</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Laboratory testing in accordance with IMO Resolution MSC.288(87), App.1</td>
<td>Lab test criteria in IMO Resolution MSC.288(87)</td>
<td>Acceptance criteria in IMO Resolution MSC.288(87)</td>
<td></td>
<td>Report by a laboratory approved as a Service Supplier</td>
<td></td>
</tr>
</tbody>
</table>
### Cross-over test

<table>
<thead>
<tr>
<th>Property</th>
<th>Test Standard</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>IMO Resolution MSC.288(87), App.1, Appendix 2, Immersion test cyclusor</td>
</tr>
<tr>
<td></td>
<td>IMO Resolution MSC.215(82), Paragraph 1.7 of Appendix 1 to Annex 1, Test on</td>
</tr>
<tr>
<td></td>
<td>simulated ballast tank condition (without wave movement)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Number and selection of specimen</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>See details in Sec.2 [3.4]</td>
<td>Acceptance criteria in IMO Resolution MSC.288(87), or in IMO Resolution MSC.215(82)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Minimum level of verification</th>
<th>Frequency of verification</th>
</tr>
</thead>
<tbody>
<tr>
<td>See details in Sec.2 [3.4]</td>
<td>Report by a laboratory approved as a Service Supplier Random</td>
</tr>
</tbody>
</table>

**Applications:**
Methods 1, 2 and 3: for use in cargo oil tanks of crude oil tankers

### 4 Requirements for marking of product

The product shall be marked. The marking shall at least include the following information:

- manufacturer’s name or trade mark
- production plant/place of manufacture
- type designation/product name
- production date/batch no
- storage instruction (if relevant).

The marking shall be made in such a way that it is visible, legible and indelible. The marking of products shall enable traceability to the type approval certificate.
APPENDIX A WORK PROCESSES

Case 1 - Independent Test Laboratory

MANUFACTURER

- Confirm Class site approval

LABORATORY

- Order placed on laboratory
- Confirm class lab approval
- Sample surface preparation
- Primer application & weathering
- Top coat application
- Laboratory testing
- Pass/fail

CLASS

- Approval
- Issue report to manufacturer
- Decide on corrective action

APPLY TO CLASS FOR "TYPE APPROVAL"

- Report Acceptable

- Issue Type Approval Certificate

NO

YES
Case 2 - Independent Test Laboratory - Manufacturer Coated Tested Plates

MANUFACTURER

1. Confirm Class site approval
2. Confirm Class job approval
3. Order placed on laboratory
4. Sample surface preparation
5. Primer application & weathering
6. Examine sample & preparation
7. Top coat application
8. Lab receipt inspection
9. Laboratory testing
10. Test result (Pass/fail)
11. Apply to Class for Type Approval
12. Issue report to manufacturer
13. Decide on corrective action

LABORATORY

14. Confirm Class job approval
15. Approval
16. Witness?

CLASS

17. Approval

DECISION PATHS

- If test result is not acceptable, decide on corrective action.
- If test result is acceptable, issue Type Approval Certificate.

Flowchart Diagram Connections:
- MANUFACTURER to LABORATORY: Confirm Class job approval
- LABORATORY to CLASS: Approval
- CLASS to MANUFACTURER: Approval
- CLASS to LABORATORY: Witness?
- LABORATORY to MANUFACTURER: Witness?
- MANUFACTURER to LABORATORY: Sample surface preparation
- LABORATORY to MANUFACTURER: Examine surface & preparation
- MANUFACTURER to LABORATORY: Primer application & weathering
- LABORATORY to MANUFACTURER: Top coat application
- MANUFACTURER to LABORATORY: Lab receipt inspection
- LABORATORY to MANUFACTURER: Laboratory testing
- MANUFACTURER to LABORATORY: Test result (Pass/fail)
- LABORATORY to MANUFACTURER: Issue report to manufacturer
- MANUFACTURER to LABORATORY: Decide on corrective action
- CLASS to MANUFACTURER: Issue Type Approval Certificate
- CLASS to LABORATORY: Report Acceptable

Flowchart Diagram Details:
- Diamonds represent decision points or checks (e.g., Confirm Class site approval, Witness?).
- Rectangles represent actions or steps (e.g., Order placed on laboratory, Sample surface preparation).
- Arrows indicate the flow of the process from one step to another, connecting the different parts of the process.
- The diagram illustrates the process flow for testing and approval, starting from verifying site and job approvals, progressing through material preparation and testing stages, and concluding with final approval or corrective action decisions.
Case 3 - Manufacturers Approved Test Laboratory

<table>
<thead>
<tr>
<th>MANUFACTURER</th>
<th>LABORATORY</th>
<th>CLASS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Apply to Class Type Approval</td>
<td></td>
<td>Approval</td>
</tr>
<tr>
<td>Confirm Class site approval</td>
<td></td>
<td>Approval</td>
</tr>
<tr>
<td>Sample surface preparation</td>
<td></td>
<td>Witness?</td>
</tr>
<tr>
<td>Primer application &amp; weathering</td>
<td></td>
<td>Witness?</td>
</tr>
<tr>
<td>Top coat application</td>
<td></td>
<td>Examine surface &amp; preparation</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Post coating inspection</td>
</tr>
<tr>
<td></td>
<td>Laboratory testing</td>
<td>Witness during test</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Witness evaluation of test</td>
</tr>
<tr>
<td></td>
<td>Pass/fail</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Issue report to Class</td>
<td>Report Acceptable</td>
</tr>
<tr>
<td>Decide on corrective action</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Issue Type Approval Certificate</td>
</tr>
<tr>
<td></td>
<td>Yes</td>
<td></td>
</tr>
</tbody>
</table>
APPENDIX B GUIDELINES ON FORMULATION AND NAME CHANGES IN RELATION TO IMO PSPC COATING SYSTEM TYPE APPROVAL

1 Allowed changes without reference to DNV GL

— generic equivalent raw material substitutions to allow best use of local suppliers and costs.
— changes to formulations where the infrared (IR) identification ("fingerprint") or the specific gravity (SG) of each component is not changed to alter drying/application performance to suit local ambient conditions and shipyard practices. This could involve:
  a) changes in thixotrope package to improve hold up
  b) change in solvent to speed up/slow down drying
  c) changes in, or addition of, additives, e.g. to control flow and levelling or to prevent bubbling, pinholing or other film defects.
   — adjustment in level or type of inert colouring pigments for paint colour changes.
   — change in specific gravity by not more than +/-0.05g/ml.
   — change in the absolute quantity of any raw material in a formulation by not greater than 2% to allow for use of different manufacturing equipment or and/or manufacture of different batch sizes, e.g. if a raw material is nominally present as 10% by weight in a formulation, a range of 9.8 – 10.2% may be used.

2 Allowed changes with reference to DNV GL, but without re-testing to IMO PSPC

— addition of, or change in level of, catalyst where the IR "fingerprint" is not changed.
— change in hydrolysis and esterification level of binders in zinc silicate shop primers.
— change in extender pigment type, where the IR "fingerprint" is not significantly changed.
— change in pigment volume concentration (PVC) by not more than +/-2%.
— any change that does not alter the dry paint film composition, e.g. change in product mixing ratio where the mixed formulation remains the same.
— changes of solvent blends that change the SG of each component.
— changes of name and/or type designation without any formulation change.

   Note:
   Formulation changes of this type shall be strictly controlled and shall be dependent on successful completion of significant internal test programme.

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3 Changes not allowed without full re-testing to IMO PSPC and subsequent type approval

— any changes that significantly alter the IR "fingerprint" of the coating.
— significant changes (greater than +/-2%) to pigment volume concentration (PVC).
— changes to the film forming resin system.
— changes to resin system including hardener.
— addition of modifying resins.
— change to type, or level, of active pigments, e.g. zinc dust in shop primers and aluminium in water ballast tank coatings.
Driven by our purpose of safeguarding life, property and the environment, DNV GL enables organizations to advance the safety and sustainability of their business. We provide classification and technical assurance along with software and independent expert advisory services to the maritime, oil and gas, and energy industries. We also provide certification services to customers across a wide range of industries. Operating in more than 100 countries, our 16 000 professionals are dedicated to helping our customers make the world safer, smarter and greener.